Finite element modelling of the performance of hybrid foundation systems for offshore wind turbines

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Abstract

This paper presents the results of a series of numerical simulations predicting the performance of a novel hybrid suction caisson foundation used for offshore wind turbines under overturning moment. The proposed new winged foundation is a hybrid foundation system that utilises steel plate sections attached to a caisson shaft (also steel), to increase its overturning capacity. In this study, a numerical 3D finite-element model with an elasto-plastic soil constitutive model, is developed to simulate the soil-caisson interaction and evaluate the additional overturning capacity provided by the wings. Results indicate significant contribution of the wings to increases overturning capacity compared to a simple caisson foundation through changes in the failure mechanism. The increase in overturning resistance provided by placing wings on a caisson is illustrated by presenting the results for a suction caisson with aspect ratio (embedment length/diameter) of 1. The effect of shape and size of the wing on overturning capacity is investigated.